## REMARKS

Claims 1, 5, 7 and 11 are amended herein. Claims 1-14 remain pending in the application.

### Claims 7-14 over Meyers

In the Office Action, claims 7-14 were rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Meyers, U.S. Patent No. 4,817,149 ("Meyers"). The Applicant respectfully traverses the rejection.

Claims 7-14 recite, *inter alia,* selecting one of a plurality of available digital first time delays having a first resolution between each of the plurality of available first time delays, the first resolution being an **integer value** providing a rough estimate of a desired interaural time delay, additionally selecting one of a plurality of available digital second time delays having a second resolution, each of the plurality of available second time delays being a **fractional delay** providing a highly refined additional time delay, and adding the selected digital first time delay and the digital second time delay to provide a desired interaural time delay for use in a digital 3D sound system to create a perceived positional sound.

Meyers appears to disclose an artificial, three dimensional auditory display which artificially imparts localization cues to a multi-frequency component electronic signal sound source (Abstract). The signal is split into two signals with one of them being delayed by a selected amount not greater than 0.67 milliseconds (Meyers, Abstract). A plurality of head localization time delays are used in conjunction with variable time delays to impart an azimuth cue (Meyers, Fig. 20; col. 13, lines 36-53). An audio position control computer 200 controls the application of the time delays to the two signals (Meyers, Fig. 1).

Meyers discloses an audio position control computer that controls various time delays to create exact return directions and vectorizing (col. 15, lines 50-53). However, the various time delays are **NOT** disclosed as being digital time delays, as recited by claims 7-14.

Moreover, the time delays disclosed by Meyers are not greater than 0.67 milliseconds. Applicant's invention uses an integer value time delay

6

providing a <u>rough estimate of a desired interaural time delay</u>, as recited by claims 7-14.

Meyers fails to disclose using an **integer digital delay** in combination with a **fractional digital delay**, much less selecting one of a plurality of available <u>digital first time delays</u> having a first resolution between each of the plurality of available first time delays, the first resolution being an **integer value** <u>providing a rough estimate of a desired interaural time delay</u>, additionally selecting one of a plurality of available <u>digital second time delays</u>, each of the plurality of available second time delays being a **fractional delay** <u>providing a highly refined additional time delay</u>, and adding the selected digital first time delay and the digital second time delay to provide a desired interaural time delay for use in a <u>digital 3D sound system</u> to create a perceived positional sound, as recited by claims 7-14.

As Applicant discussed in the background of the invention, conventional 3D sound systems employing delay use analog components. There are at least two basic problems with the implementation of the conventional analog approach in a digital environment. First of all, the large resolution in the available time delays cause discretely sampled interaural time differences for the expected position of a listener. Thus, a 'closest' or 'best fit' interaural time difference (ITD) must be chosen, which may be up to 50% away from the ideal parameter. This may cause a jittering effect in the sense of movement of the sound by the listener. Moreover, implementation of a digital filter emulating an analog filter having multiple taps (as shown Applicant's Fig. 6) is computationally involved, providing a level of system inefficiency from a computational view.

Morover, with a conventionally proposed implementation of a digital 3D sound system to provide a more accurate ITD based on the given resolution has been to interpolate an entire head-related transfer function (HRTF) set such that the ITD becomes interpolated as well. Unfortunately, interpolation itself can become a computationally intense requirement which likely adds to, rather than cures, the computational inefficiency otherwise associated with digital 3D sound systems. Applicant's invention overcomes the deficiencies in the cited prior art

by using two digital delays, an <u>integer</u> and a <u>fractional</u> delay, added together to created a perceived positional sound.

Accordingly, for at least all the above reasons, claims 7-14 are patentable over the prior art of record. It is therefore respectfully requested that the rejection be withdrawn.

## Claims 1-4 and 6 over Meyers in view of Matsumoto

In the Office Action, claims 1-4 and 6 were rejected under 35 U.S.C. §103(a) as allegedly being obvious over Meyers in view of Matsumoto, U.S. Patent No. 5,381,482 ("Matsumoto"). The Applicant respectfully traverses the rejection.

Claims 1-4 and 6 recite, *inter alia,* a first <u>digital delay module</u> providing a choice of delay within a first resolution for use in a 3D audio sound system, the first resolution being an <u>integer value</u>, a second <u>digital delay module</u> in series with the first delay module, the second digital delay module providing a choice of a plurality of additional <u>fractional delays</u>, each of the additional fractional delays being less than the first resolution, where the first resolution is added to the additional fractional delays for use in the 3D audio sound system to create a  perceived positional sound.

As discussed above, Meyers appears to disclose an artificial, three dimensional auditory display which artificially imparts localization cues to a multi-frequency component electronic signal sound source (Abstract). The signal is split into two signals with one of them being delayed by a selected amount not greater than 0.67 milliseconds (Meyers, Abstract). A plurality of head localization time delays are used in conjunction with variable time delays to impart an azimuth cue (Meyers, Fig. 20; col. 13, lines 36-53). An audio position control computer 200 controls the application of the time delays to the two signals (Meyers, Fig. 1).

Meyers discloses an audio position control computer that controls various time delays to create exact return directions and vectorizing (col. 15, lines 50-53). However, the various time delays are **NOT** disclosed as being <u>digital</u> time delays, as recited by claims 1-4 and 6.

The Office Action correctly acknowledged that Meyers fails to disclose a digital delay line for use in an audio sound system where a second delay module produces an additional delay which is a fraction of/less than a first delay produced by a first delay module in series (Office Action, page 5). The Office Action relies on Matsumoto to allegedly make up for the deficiencies in Meyers to arrive at the claimed invention. The Applicant respectfully disagrees.

Matsumoto appears to disclose a sound field controller for generating apparent sound sources by adjusting an amplitude and delay time of a sound signal so that the sound will be perceived by a plurality of listeners (Abstract). An embodiment uses integer delay values in one path of a sound signal and fractional delay values in a second **separate** path of the sound signal (Fig. 4, items 32, 33, 41 and 42).

Although Matsumoto discloses using an integer delay and a fractional delay for a sound system, the delays are used in separate paths of a sound signal. The integer delay and fractional delay are not **added** to create a perceived positional sound, as recited by claims 1-4 and 6.

Neither Meyers nor Matsumoto, either alone or in combination, disclose, teach or suggest **adding** an integer delay and a fractional delay, much less a first digital delay module providing a choice of delay within a first resolution for use in a 3D audio sound system, the first resolution being an integer value, a second digital delay module in series with the first delay module, the second digital delay module providing a choice of a plurality of additional fractional delays, each of the additional fractional delays being less than the first resolution, where the first resolution is **added** to the additional fractional delays for use in the 3D audio sound system to create a perceived positional sound, as recited by claims 1-4 and 6.

Accordingly, for at least all the above reasons, claims 1-4 and 6 are patentable over the prior art of record. It is therefore respectfully requested that the rejection be withdrawn.

## Claim 5 over Meyers in view of Matsumoto and Nagata

In the Office Action, claim 5 was rejected under 35 U.S.C. §103(a) as allegedly being obvious over Meyers in view of Matsumoto, and further in view of Nagata, U.S. Patent No. 5,974,154 ("Nagata"). The Applicant respectfully traverses the rejection.

Claim 5 is dependent on claim 1, and is allowable for at least the same reasons as claim 1.

Claim 5 recites, *inter alia,* a first <u>digital delay module</u> providing a choice of delay within a first resolution for use in a 3D audio sound system, the first resolution being an <u>integer value</u>, a second <u>digital delay module</u> in series with the first delay module, the second digital delay module providing a choice of a plurality of additional <u>fractional delays</u>, each of the additional fractional delays being less than the first resolution, where the first resolution is added to the additional fractional delays for use in the 3D audio sound system to create a perceived positional sound.

As discussed above, neither Meyers nor Matsumoto, either alone or in combination, disclose, teach or suggest **adding** an <u>integer delay</u> and a <u>fractional delay</u> for use in a 3D audio sound system to create a perceived positional sound, as recited by claim 5.

The Office Action correctly acknowledged that Meyers and Matsumoto fails to disclose an integer and fractional delay selector adapted to determine a first time delay for use by a first delay module and an additional fractional delay for use in a second delay module (Office Action, page 6). The Office Action relies on Nagata to allegedly make up for the deficiencies in Meyers and Matsumoto to arrive at the claimed invention. The Applicant respectfully disagrees.

Nagata appears to disclose an echo effector for imparting an echo effect to an audio signal based on values of a plurality of parameters (Abstract). A dial is actuated for independently setting one or more of the parameters to desired values (Nagata, Abstract). A microprocessor dependently sets the remaining parameters to appropriate values according to the desired values (Nagata, Abstract). A first delay unit has a plurality of output terminals which

output stepwise delayed signals having setpwise different delay times (Nagata, col. 4, lines 60-62). A second delay unit, connected to the first delay unit, outputs from terminals delayed signals having stepwise different delay times (Nagata, col. 5, lines 24-26). A switch group or matrix, a plurality of dials, and a command switch are used to for setting and selecting the amount of echo effect (Nagata, col. 5, lines 6-10).

Nagata teaches adding <u>echo</u> effect to an audio signal. A system for adding <u>echo</u> to an audio signal is **NOT** a <u>3D audio sound system</u>. Moreover, <u>echo</u> does not create a <u>perceived positional sound</u>. Nagata fails to disclose or suggest **adding** an <u>integer delay</u> and a <u>fractional delay</u> for use in a <u>3D audio sound system</u> to create a perceived <u>positional sound</u>, as recited by claim 5.
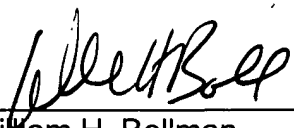
Neither Meyers, Matsumoto nor Nagata, either alone or in combination, disclose, teach or suggest a first <u>digital delay module</u> providing a choice of delay within a first resolution for use in a 3D audio sound system, the first resolution being an <u>integer value</u>, a second <u>digital delay module</u> in series with the first delay module, the second digital delay module providing a choice of a plurality of additional <u>fractional delays</u>, each of the additional fractional delays being less than the first resolution, where the first resolution is **added** to the additional fractional delays for use in the 3D audio sound system to create a perceived positional sound, as recited by claim 5.

Accordingly, for at least all the above reasons, claim 5 is patentable over the prior art of record. It is therefore respectfully requested that the rejection be withdrawn.

## Conclusion

All objections and rejections having been addressed, it is respectfully submitted that the subject application is in condition for allowance and a Notice to that effect is earnestly solicited.

Respectfully submitted,

William H. Bollman
Reg. No. 36,457

**Manelli Denison & Selter PLLC**
2000 M Street, NW
Suite 700
Washington, DC  20036-3307
TEL. (202) 261-1020
FAX. (202) 887-0336

WHB/